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# EXPERIMENTS WITH SHEEP.

JAMES WILSON.

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We conducted experiments with sheep during the past winter. The College owns seven breeds of registered sheep. They were wintered in a comfortable barn, where each lot could be controlled in all its relations. Grain, hay, water, and facilities for weighing were all convenient. The sheep were gentle and familiar with the herdsman, who did all the feeding and weighing, and made written reports daily, that were recorded. Every provision that could be made to secure accurate work was at hand. The experiment began Dec. 10th and continued for 90 days, to March 7th.

We had in view the amounts of grain and hay necessary to winter each breed, the gain or loss in weight, the cost of the feed, the average feed and weight for the whole flock, the wool clipped from each breed, unscoured and scoured, the comparative value in both conditions, the comparison of the wools of the different breeds under the microscope, the loss in scouring of each breed, and the average value of wool from each breed.

Four Merinoes, 4 Cotswolds, 4 Dorsets, 4 Oxfords, 3 Hampshires, 3 Shropshires and 3 Southdowns, all ewes, were selected for the experiment. Each breed was put in a secure pen with convenient hay racks, and grain mangers, where the feed given was not wasted to any extent.

Several ewes dropped lambs during the 90 days that would vary conditions should they be compared with the rest. For this reason we first consider a period of 53 days, beginning December 10th, and ending February 1st, during which time no lambs came.

TABLE NO. I.

*Feeding and results December 10th, 1891, to February 1st, 1892.*

	Weight, Dec. 10, '91.	Mixed grain eaten.	Clover and Timothy hay eaten.	Weight, Jan. 31, '92.	Total gain.	Total cost of feed for each lot.	Pounds of grain per day for each sheep.	Pounds hay per day for each sheep.	Total cost of feed per day for each sheep.	Pounds gain per day for each sheep.
4 Merino ewes. ....	419	148½	286½	465 46		\$2.20	.70	1.35	\$.0103	.21
4 Cotswold " ....	700	201½	345	739 39		2.87	.95	1.62	.0235	.18
3 Dorset " ....	465	123	282	494 29		1.93	.77	1.77	.0121	.18
2 Oxford " ....	321	201½	316	356 35		2.80	.95	1.49	.0132	.24
2 Oxford lambs. ....	220			236 16						
3 Hampshire ewes. .	460	136	266	483 23		2.02	.85	1.67	.0126	.14
3 Shropshire " ..	537	89¾	260½	560 23		1.54	.56	1.64	.0097	.14
2 Southdown " ..	276	43½	210	283 7		.95	.27	1.32	.006	.094
1 " lamb. .	69			77 8						

This table shows the total amount of feed consumed during the first period of 53 days; the total amount of feed consumed by each breed, and the cost; the average daily consumption of grain and hay per head for each breed; the average daily cost of feed per head for each breed, and the average daily gain for each sheep. They were breeding ewes and increased weight was not an object of the experiment, while with young growing ewes increased weight was to be expected, and the gain represents growth rather than fattening.

This table shows that four Merino ewes ate an average of .7 of a pound of grain and 1.35 pounds of hay each, per day, during the 53 days, valued at \$2.20, the grain being estimated at one cent per pound and the hay at a quarter of a cent per pound. During the same time four Cotswolds ate .95 pounds of grain and 1.62 pounds of hay each, amounting to \$2.87. Three Dorsets ate .77 pounds of grain and 1.76 pounds of hay each, amounting to \$1.93. Four Oxfords ate .95 pounds of grain and 1.49 pounds of hay each, amounting to \$2.80. Three Hampshires ate .85 pounds of grain and 1.67 pounds of hay each, amounting to \$2.02. Three Shropshires ate .56 pounds of grain and 1.64 pounds of hay each, amounting to \$1.54. Three Southdowns ate .27 pounds of grain and 1.32 pounds of hay each, amounting to 95 cents.

The daily cost of feed per sheep in each breed was, for Merinos 1.03 cents; Cotswolds 1.35 cents; Dorsets 1.21 cents; Oxfords 1.32 cents; Hampshires 1.26 cents; Shropshires .97 cents, and Southdowns .60 cents.

The gain per day in fractions of a pound for each sheep was, for the Merinos .21; Cotswolds .18; Dorsets .12; Oxfords .24; Hampshires .10; Shropshires .10; Southdowns .7.

The sheep were all coming two years old, excepting two Oxfords and one Southdown that were coming one year-old; and one 4 year old Shropshire; the table shows the gain separately made by the yearlings.

The average gain made by the several breeds varies, and is not large in any case, the intention being merely to maintain the flock in good breeding condition. The foregoing figures fairly represent the relative cost of wintering breeding ewes of these breeds under conditions given in this experiment.

The flock was turned out only for exercise, in fair weather, in closed yards, without access to grass or forage of any kind except as herein stated. Flocks can be most economically wintered with access to pastures, meadows and stalk fields during winter, unless prevented by deep snows, considerably reducing the cost of wintering below our figures; but this station thought it wise to ascertain for the flockmasters of the northwest the actual cost of maintaining a breeding flock under rigid conditions.

One of the Dorset ewes lambled in December and another in the latter part of January, and the four Merinos dropped lambs about the first of March. In reporting results in the following table, which covers the 90 day period for all ewes except those lambing within the time, the first Dorset was left out entirely; the second one was taken from the lot on the 10th day of February. None of the Merinos are reported after February 1st. It will therefore be seen that none of these ewes were carried in the experiment close up to the time of parturition.

TABLE NO. 2.

*Feeding and results December 10, 1891, to March 7, 1892.*

	Days feed for one sheep.	Average pounds grain for one sheep.	Average pounds of hay for one sheep.	Average daily grain per sheep.	Average daily hay per sheep.	Weight December 10, 1891.	Weight March 7, 1892.	Pounds of gain.	Average cost of gain per pound for flock.	Average daily cost of feed per sheep in each breed.
4 Merinos.....	212 148½	286½	0.70	1.35	419 465	46	....	.0104		
4 Cotswolds.....	360 297½	552	0.82	1.53	700 753	53	....	.0121		
3 Dorsets.....	244 179¼	413	0.73	1.69	465 505	40	....	.0116		
2 Oxford ewes )	360 297½	522	0.82	1.45	{ 321 378 }	87	....	.0118		
2 " lambs )					{ 220 250 }					
3 Hampshires.....	270 190	412	0.70	1.52	460 492	32	....	.0108		
3 Shropshires.....	270 143¾	404	0.53	1.49	537 570	33	....	.009		
2 Southdown ewes )	270 81	343	0.30	1.27	{ 276 297 }	32	....	.0061		
1 " lamb )					{ 69 80 }					
	1986	1337.5	2932.5	0.67	1.47	.....	.....	323	.064	.....

On account of the feeding periods not being uniform in all cases it was thought best to reduce results to a basis of one sheep for a given number of days, in order to secure better comparisons. It will be seen that the results of the above table in general confirm those obtained in the 53 day period. Different lengths of feeding periods generally give varying results, the conclusions of these two periods are so nearly alike that they corroborate each other for all practical purposes.

The only material difference found in the average daily expense of wintering for each breed being a reduction in the Cotswolds, Oxfords and Hampshires, this comes from a reduction of the grain ration during the period; at the beginning the sheep of these three breeds had one pound of grain per day each; this was continued until January 10th, when it was thought that the grain feeding could be reduced; from that date until the close, the four Cotswolds and four Oxfords had three and a half pounds each, and the three Hampshires had two pounds per day until January 28th; from that date to the close their daily allowance was one and a half pounds of grain.

It will be observed that the thrift of the flock was continuous. The 53 day period shows a gain of 226 pounds, and the 90 day period a gain of 323 pounds.

During the last 60 days of the feeding period all the sheep had a pound each of sliced sugar beets twice a week, care being taken to avoid feeding the roots in a chilled condition. This was increased after lambing to a pound each day. The roots were always relished.

The grain ration varied in composition during the feeding period to suit the needs of the ewes at different stages of pregnancy. The grain mixture was one-half oats (50 lbs.), three-eighths corn ( $37\frac{1}{2}$  lbs.), and one-eighth oil meal ( $12\frac{1}{2}$  lbs.), at the beginning. On December 19th it was changed to one-half oats (75 lbs.), one-fourth corn ( $37\frac{1}{2}$  lbs.), one-fifth bran (30 lbs), and one-twentieth oil meal ( $7\frac{1}{2}$  lbs.). At the first of February the corn was left out, the other ingredients were left the same. Each breed had the same mixture during the experiment. The grain ration gave good results in all respects. The ewes were in excellent condition at lambing time and both the dams and progeny did well. The hay consisted of a mixture of timothy and clover, mainly clover, of fair quality.

This completes the feeding feature of the experiment. We take up the wool next. The following table gives the yield of wool by each sheep, and average for the breed; the weight of each sheep after shearing, and average for the breed; the per cent of shrinkage in scouring; the market value scoured and unscoured; average value of fleece for each breed scoured and unscoured; and microscopic measurements of each fleece, giving average decimeter of fibres, average serrations per inch, and average of the same for each breed:

WOOL TABLE.

	Age.	Weight of fleece—pounds.	Weight of sheep after shearing.	Average fibres per inch.	Average serrations per inch.	Average per cent of scoured wool.	Average selling price unscoured.	Average selling price—scoured.	Average value of wool per head—unscoured.	Average value of wool per head—scoured.
Merino ewe, 125.....	2 yrs.	12¾	91½	1397	2520	.....	.....	.....	.....	.....
“ 126.....	“	15¼	89	1324	2550	.....	.....	.....	.....	.....
“ 127.....	“	12½	72	1318	2720	.....	.....	.....	.....	.....
“ 128.....	“	15	82	1371	2280	.....	.....	.....	.....	.....
Merino ram, 140.....	“	16	123	1500	2673	.....	.....	.....	.....	.....
Merino average.....	.....	14.3	91.5	1342	2548.6	33.4	\$ .21	\$ .58	\$3.00	\$2.77
Cotswold ewe, 100.....	2 yrs.	10%	200	641	1593	.....	.....	.....	.....	.....
“ 101.....	“	13¼	169	673	1420	.....	.....	.....	.....	.....
“ 102.....	“	15%	187	634	1260	.....	.....	.....	.....	.....
“ 103.....	“	11½	155	709	1620	.....	.....	.....	.....	.....
Cotswold ram, 115.....	“	19	200	545	1440	.....	.....	.....	.....	.....
Cotswold average.....	.....	14.07	182	640	1466	64.2	.22	.40	3.09	3.61
Dorset ewe, 150.....	2 yrs.	6¼	137	700	2180	.....	.....	.....	.....	.....
“ 151.....	“	7	155	709	2162	.....	.....	.....	.....	.....
“ 152.....	“	8¾	141	670	2480	.....	.....	.....	.....	.....
“ 153.....	“	9	154	753	2100	.....	.....	.....	.....	.....
Dorset ram, 165.....	“	11	226	659	1980	.....	.....	.....	.....	.....
Dorset average.....	.....	8.35	162	698	2180	50.3	.25	.42½	2.09	1.78

Oxford ewe, 75	2 yrs.	15½	168	636	1426					
" 76	"	12	165	749	1620					
" 77	1 yr.	10¾	115	618	1740					
" 78	"	9¼	105	755	2100					
Oxford ram, 90	"	12¾	181	760	1900					
Oxford average		12.05	147	703	1757	55.4	.25	.42½	3.01	2.83
Hampshire ewe, 50	2 yrs.	9¼	164	866	1940					
" 51	"	10¾	171	861	1820					
" 52	"	9	116	745	1760					
Hampshire ram, 65	1 yr.	9¼	152	790	1970					
Hampshire average		9.46	151	813	1872	48.3	.25	.42½	2.36	1.94
Shropshire ewe, 1	2 yrs.	8½	147	769	1920					
" 2	"	12¾	156	742	2090					
" 3	4 yrs.	7	197	714	1800					
Shropshire ram, 15	1 yr.	13¾	136½	750	1960					
Shropshire average		10.5	159	743	1942	47.3	.25	.42½	2.62	2.11
Southdown ewe, 25	2 yrs.	9	138½	818	2300					
" 26	"	7	124	895	2100					
" 27	1 yr.	6¾	75	923	2160					
Southdown ram, 40	2 yrs.	9	158	908	2400					
Southdown average		7.93	124	886	2240	50.3	.25	.42½	1.98	1.69



The shearing began at a festival held at the college for that purpose on the 13th and 14th of April and was completed on the 15th and 16th. The fleeces were entirely dry and practically free from dirt and foreign matter and were all carefully and neatly tied as soon as shorn. The shearing and tying were done in competition, and under the supervision of expert judges. The fleeces were placed on shelves in a clean dry place. They were shipped to the D. W. Jones & Son woolen mills, Manchester, Iowa, in the latter part of May, where they were carefully weighed, and the wool from each breed scoured separately and the shrinkage of each determined as shown by the table. It was found that there was no shrinkage in the wool from the time it was sheared in April until the date of weighing, preparatory to scouring June 19.

The station is weighing a quantity of wool, once a month during a year, under four different conditions, with a view to studying change of weight. The market value of the wool from each breed was estimated by Messrs. Jones & Son and Messrs. Justice Bateman & Co., of Philadelphia, as shown by the table.

The ratings of the wools of the different breeds, by those gentlemen, are as follows:

	PRICE.		
	Unwashed.	Fleece Washed.	Scoured.
Cotswold, classified as braid combing, worth.....	22	32	40
Southdown, classified as low medium or $\frac{1}{4}$ blood, worth	25	33	42 $\frac{1}{2}$
Oxford, " " " "	25	33	42 $\frac{1}{2}$
Shropshire, " " " "	25	33	42 $\frac{1}{2}$
Hampshire, " " " "	25	33	42 $\frac{1}{2}$
Dorset, " " " "	25	33	42 $\frac{1}{2}$
Merino.....	21	29	58

These gentlemen further say that the Southdown and Hampshire are "a shade finer than the others but in subdivisions here all would be classed as  $\frac{1}{4}$  bloods."

The microscopic measurements, given in the table, show the relative fineness of the wool of the several breeds. The

figures given for each animal represent the average of five measurements from three samples of each fleece, taken at time of shearing, one from the shoulder, one from the the loin, and one from the thigh, thus making fifteen measurements to determine average diameter and fifteen for average serrations of the fleece of each sheep. For the careful performance of the details of this part of the work and also of the measurements made in comparing several commercial grades, we are indebted to Mr. T. T. Rutledge, a senior student in the agricultural course.

A part of this wool was in competing classes, at the shearing contest, and was shipped to H. T. Thompson & Co., wool commission merchants of Chicago. While there the following estimates were placed upon it, May 9th, upon the basis of the Chicago market: Merino, 20 cts; Shropshire, 22 cts; ann Southdown, 23 cts. In this market the wool of the Southdown was graded one cent above the Shropshire.

The wool table shows that the wool shrunk in scouring from 35.8 in the Cotswold, to 66.6 in the Merino; and in computing the average value of wool per head, scoured and unscoured, at the prices fixed by the parties named, the unscoured valuation is the highest with one exception—the Cotswold. We cannot explain why there is more value in an unscoured than in a scoured fleece. The shrinkage of our wool was probably below the normal. The classification of wool of the various grades by commission firms and manufacturers is of considerable interest to the producer. In answer to a request to define some of the leading grades, Messrs. Justice Bateman & Co., of Philadelphia, furnished samples and quoted prices of four grades, and wrote as follows: "Low medium" means a quarter blood, and corresponds with the wool coming from the Shropshire sheep, and "quarter blood" alludes to a remote cross of Merino blood, and "fine medium" is a half blood Merino. "Medium combing" is a combing out of half blood Merino.

The "combing" is a long fibre used on worsted machines. The "clothing" is a shorter fibre which is carded if put into fulled goods, and combed after it is carded if put into worsted goods. At present worsted machinery has been perfected to such a degree that they can comb and make worsted goods

out of almost any kind of wool with a staple  $1\frac{1}{2}$  inches long. It is only a matter of how far it is profitable to comb short wools. When long wools are worth the same price as short ones they comb only the long ones, but if they are much dearer than the short wools they neglect the high price long wools and comb the shorter ones. The difference in the profit is represented by the greater loss in waste in coming the short fibres."

Below we give names of grades with price of each (fleece washed) and microscopic measurements and length of each sample, in order to enable the reader to compare with the wool of different breeds as given in table showing wool records of the flock:

DESCRIPTION OF GRADE.	Value in Philadelphia market, July 25, 1892.	Average length of fibre—inches.	Average number of fibres per inch.	Average number of serrations per inch.
Low medium clothing.....	32½-33c.	3½	759	2280
Low medium combing.....	33-33½c.	5½	705	1818
Medium clothing.....	33-34c.	2½	1250	2520
Medium combing.....	35c.	8½	909	2340

The above prices are for fleece washed wool and are about eight cents higher than for unwashed wool.

Each grade of wool was represented by three samples and the figures given in table are the average of five measurements of each. The average length of fibre was not taken for the station flock, but average shoulder samples measured as follows: Shropshire, Hampshire and Dorset, each, four inches; Southdown three and a half, Oxford five and a half, Cotswold nine, and Dickinson Merino three and one-fourth inches. The microscope of course does not accurately and fully indicate the market value of wool, but the comparisons here made are sufficient to show that the wool of some of the medium breeds does not fall far below the best selling grade medium combing. Improvement of our sheep in a systematic and understanding way, by careful selection and proper handling, will undoubtedly bring our flocks to a higher standard in both wool and mutton production.

The average period of gestation was  $146\frac{1}{2}$  days for the Shropshires,  $143\frac{1}{2}$  for the Hampshires,  $147\frac{1}{2}$  for the Ox-Oxfords,  $144\frac{3}{4}$  for the Cotswolds, 149 for the Merinos, and  $148\frac{1}{3}$  for the Dorsets, giving an average of 146.6 for the flock. The average weight of lambs when dropped was  $8\frac{2}{3}$  pounds for the Shropshires,  $7\frac{1}{2}$  for the Hampshires,  $8\frac{1}{4}$  for the Oxfords, 8 for the Cotswolds,  $8\frac{1}{8}$  for the Merinos, and  $9\frac{3}{4}$  for the Dorsets.